

mountain regions in northeastern California. In west-central Colorado forty-eight inches were reported; at Lick Observatory, Cal., forty inches; in extreme northern upper Michigan, forty-six inches; in east-central and northeastern Wisconsin, thirty inches; in northern Utah, twenty inches; in southeastern Wyoming more than twenty inches; and in parts of northern Illinois, northeastern, eastern, and northern Iowa, northern Minnesota, North Dakota, and Montana, more than five inches. Compared with the preceding month the southern limit of snow on the ground at the close of the respective months was somewhat farther south in the central valleys and in the Rocky Mountain and plateau regions at the end of February.

#### ○ HAIL.

Descriptions of the more severe hail storms of the month are given under the head of "Local storms." Hail was reported as follows: 1st, Ind., Ky. 2d, Mo. 5th and 6th, Kans. 7th, Ill., La., Mass., Miss., N. J., N. Y., Pa., Tex. 9th, Oregon. 10th, Wash. 11th, Oregon. 13th, Tex. 14th, Mass., Pa., Wash. 15th, Oregon, Wash. 16th, Cal., Oregon. 17th, Cal., Ind., Mich., Pa. 18th, Cal., Ind., Mass., N. Y., Pa. 19th, Cal., Ill., Ind., Iowa, Mich., Mo., Nev., N. J., N. Y., Pa. 20th, Cal., Md., Mass., N. Y., Pa. 21st, Cal., Tex. 22d, Cal., S.

C., Tenn. 23d, Cal., Ill., Mo., Oregon, Tenn., Tex. 24th, Ala., Ark., Ga., Ill., Ind., Ky., Miss., Mo., Ohio, Tenn., Tex. 25th, Ala., Ark., Cal., Ind., Iowa, Ky., Miss., Mo., N. Y., N. C., S. C., Tenn., Tex., Va. 26th, Ga., Kans., Ky., La., Miss., Mo., N. C., Tenn., Tex. 27th, Ala., Ill., Kans., La., Miss., Mo., Tex. 28th, Ill., Me., Nev., N. J., Tex.

#### ○ SLEET.

Sleet was reported as follows: 1st, Cal., Ill., Ind., Ky., Pa., Va. 2d, Conn., Mass., Pa. 3d, N. Y. 4th, Mich., Minn., N. Y., Vt. 5th, Ill., Mo., N. C., Tenn., Vt. 6th, Ill., Kans., Md. 7th, Ill., Ind., Kans., Minn., Mo., Nebr., N. J., N. C., Ohio, Pa., S. C., Tenn., Va. 8th, Me., Mass., N. Y., S. C., Tenn., Vt. 9th, Conn. 12th, Me., N. Y. 13th, Tex. 14th, N. Y., Wash. 15th, Oregon, Wash. 17th, Mass., Minn., N. Y., Pa. 18th, Conn., Mass., N. Y., Pa., Vt. 19th, Ill., Iowa, Mass., Mich., N. J., N. Y., Ohio, Pa., Va. 20th, Cal., Conn., N. Y., Pa. 21st, Cal., N. Mex. 22d, Cal., Ill., Ind., Kans., Mo., N. Y., N. C., S. C. 23d, D. C., N. C., Utah. 24th, Me., N. Mex., Oregon, Tenn. 25th, Ill., Kans., Mo., Tenn., Tex. 26th, Ill., Ind. T., Iowa, Kans., Mo., Tenn. 27th, Ariz., Ark., Ill., Ind. T., Iowa, Kans., Mo., N. Y., Tex. 28th, Ill., Ind., Me., Mich., Miss., N. J.

#### ○ WINDS.

The prevailing winds during February, 1890, are shown on chart ii by arrows flying with the wind. In New England and over the middle-eastern and northeastern slopes of the Rocky Mountains the winds were mostly from north to west; in the middle Atlantic states, from northeast to northwest; in the south Atlantic states, from south to southwest; in the east Gulf states and over the northern plateau region, from southeast to southwest; in the west Gulf states, southerly; in the upper Mississippi valley and over the middle plateau region, from northwest to southwest; in the Missouri valley and the extreme northwest, from north to northwest; over the southern plateau region and on the north Pacific coast, from south to west; on the south Pacific coast, northerly; and over the Florida Peninsula, in the Ohio valley and Tennessee, the upper and lower lake regions, over the southeastern slope of the Rocky Mountains, and on the middle Pacific coast, variable.

#### ○ HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour were reported at regular stations of the Signal Service as follows: 1st, 66, s., at Fort Canby, Wash. 3d, 70, s., at Fort Canby, Wash.; 50, sw., at North Platte, Nebr.; 50, sw., at Walla Walla, Wash. 4th, 64, nw., at Bismarck, N. Dak.; 72, nw., at Fort Buford, N. Dak.; 64, w., at Cheyenne, Wyo.; 52, sw., at Fort Custer, Mont.; 84, sw., at Fort McKinney, Wyo. 6th, 60, nw., at Fort Buford, N. Dak.; 51, sw., at Wood's Holl, Mass.; 60, w., at Helena, Mont. 7th, 62, nw., at Bismarck, N. Dak.; 52, s., at Fort Canby, Wash.; 60, se., at Erie, Pa. 8th, 59, w., at Buffalo, N. Y.; 53, se., at Wood's Holl, Mass.; 60, nw., at Hatteras, N. C. 10th, 53, n., at Pueblo, Colo. 12th, 50, s., at Fort Canby, Wash. 13th, 55, w., at Whipple Barracks (Prescott), Ariz. 15th, 50, nw., at Wood's Holl, Mass. 16th, 50, nw., at Wood's Holl, Mass.; 54, sw., at Winnemucca, Nev.; 52, s., at Whipple Barracks (Prescott), Ariz. 19th, 52, sw., at Whipple Barracks (Prescott), Ariz. 21st, 65, sw., at Whipple Barracks (Prescott), Ariz.; 60, nw., at Wood's Holl, Mass.; 54, nw., at Block Island, R. I. 23d, 50, w., at Cheyenne, Wyo. 25th, 60, se., at Lexington, Ky. 26th, 54, sw., at Fort Stanton, N. Mex. 28th, 58, w., at Buffalo, N. Y.

#### ○ LOCAL STORMS.

Destructive local storms were reported in Geneva county, Alabama, on the 7th, and in Talladega and Pickens counties, Alabama, and in Kemper county, Miss., on the 27th; a severe thunder-storm was reported at Meridian, Miss., on the 7th; a

heavy hail-storm occurred at Livingston, Ala., and at Humboldt and Mason, Tenn., on the 24th; and unusually strong gales were reported at Fort Buford, N. Dak., on the 4th; at Helena, Mont., on the 6th; at points in the interior of southwestern Pennsylvania on the 7th; along the New Jersey coast from the 7th to 9th; at Lexington, Ky., Brownsville, Tenn., and Gainesville, Tex., on the 25th; at Paducah, Ky., Johnsonville, Tenn., and Marksville, La., on the 26th; at Shuqualak, Miss., on the 27th; and at Jackson, Miss., on the 28th. At Fort Buford, N. Dak., on the 4th, the wind attained an extreme velocity of ninety-six miles per hour, and the average velocity for four hours was fifty-one miles per hour. At Helena, Mont., the maximum velocity on the 6th, sixty miles per hour from the west, was the highest velocity recorded at that place since the establishment of the Signal Service station in 1879. Prof. M. L. Ray, Superintendent of Education of Geneva county, Alabama, makes the following report relative to a tornado which passed over that county on the 7th: "The first place where the storm did any damage was about one-half mile south of Eunola. From there it took a course about 20° east of north, uprooting and snapping off trees of all sizes. My dwelling being in the track, was entirely swept away, and all the other houses in the place were either totally destroyed or so badly damaged as to render them almost worthless. The storm continued its destructive course for about six miles. The path of the storm is not straight, but turns first one way and then another, and sometimes seems to reach out on either side like the teeth of a saw. When the tornado approached my house we had no time to get out of its way, and we seemed to be enveloped in a cloud of sparks just as the timbers thundered around us." On the 7th a thunder, rain, and hail storm passed over Meridian, Miss.; the storm was very severe at towns to the westward of that place, and numerous washouts were reported along the railroads. At Enterprise, Miss., hail fell to a depth of several inches. Destructive storms prevailed on the 7th in Fayette, Centre, and Cambria counties, Pennsylvania. A severe storm prevailed along the New Jersey coast from the 7th to 9th, causing high tides and doing considerable damage to property. On the 18th a thunder-storm, accompanied by vivid lightning, snow, hail, and sleet, occurred at Boston, Mass., from 10.04 to 10.20 p. m. On the 24th a severe rain and hail storm occurred at Livingston, Ala.; 1.02 inch of rain fell from 3.00 to 3.30 p. m., and for ten minutes of that time the largest hail-stones ever observed in that section fell. The larger hail-stones ranged in weight from one to two ounces,

were flattened, and were from five to seven inches in circumference, and the area in which they fell was some ten or twelve miles north and south and six or seven miles east and west. A severe wind and hail storm was also reported at Humboldt and Mason, Tenn., on the 24th. At the first-named place the storm occurred at 6.30 p. m.; it came from the southwest, and the hail-stones were the size of hickory nuts. At Mason the storm occurred shortly after noon, and lasted about fifteen minutes, and some of the hail-stones were one inch in diameter. At Lexington, Ky., the wind attained an extreme maximum velocity of ninety-six miles per hour at 4.45 p. m., after which the wind increased in force, but no record could be made. On the 25th a storm passed over Gainesville, Tex., destroying several buildings. The storm was reported the most destructive that had visited that place in years. A storm from the southwest also passed over Brownsville, Tenn., on the 25th, causing damage to the amount of about \$50,000. At 3.30 p. m. of the 26th a wind storm, accompanied by hail, caused great damage to property at Marksville, La. On the same date a very destructive storm swept over Johnsonville, Tenn., and a

storm destroyed a number of buildings near Paducah, Ky. On the night of the 27th a violent wind storm visited Needmore, a small town near Talladega, Ala., doing considerable damage to property and injuring several persons. The storm swept parallel with the track of the heavy storm of twenty-two years ago, passing about two miles south of the latter; its track was strewn with timber, fragments of furniture, and household goods; large trees were twisted off at the ground, and planks and heavy timber were driven into the ground with the force of a pile-driver. On the same date a heavy storm from the southwest passed three miles south of Carrollton, Ala., at 7.30 p. m. The storm displayed the characteristics of a whirlwind; trees that had been uprooted or broken off were scattered in every direction along its path; one man was killed and several injured. But few houses were situated in its path, otherwise the damage would have been greater. Another severe storm passed about fifteen miles north of Carrollton on the same day; a destructive storm from the southwest passed through Kemper county, Mississippi, at 5 p. m.; and at night a storm caused great damage at Benton, Yazoo Co., Miss.

## INLAND NAVIGATION.

### ICE IN RIVERS AND HARBORS.

Lake Erie remained open during the month, and but little ice was reported in Lake Huron. The Signal-Service observer at Buffalo reports that navigation could have been continued at the west end of Lake Erie throughout the winter. At the close of the month Thunder Bay and Thunder River were partly covered with ice. On the 28th steamers commenced to make regular trips from Detroit, Mich., to Cleveland, Ohio. This was the earliest opening of navigation on record at the port of Detroit. On the 6th the ice ran out of the Mississippi River at Davenport, Iowa.

### FLOODS.

Owing to the rapid melting of snow which had formed in drifts fifteen to twenty feet deep in the hills and mountains of Oregon, and the excessive rains of the last of January and the first part of February, the streams in western Oregon rose rapidly, and the loss by flood in the state is estimated at not less than \$1,000,000. At Portland, Oregon, the Willamette River reached 28.7 feet on the gauge at 8 p. m. of the 5th, which was the highest point ever recorded at that place; railroad communication was cut off, and a greater part of the city was under water to a depth of two to four feet. In southern Oregon disastrous floods occurred along the Rogue River and its tributaries. The Sacramento River overflowed its banks at Red Bluff, Cal., damaging property, and in the valleys of the Eel and Mad rivers the bottom lands were flooded, and bridges, stock, and houses were carried away. Portions of Eureka, Cal., also sustained damage by flood. Considerable damage was reported near Los Angeles, Cal., by the Los Angeles River changing its course just south of that city and inundating a considerable extent of country. The continued heavy rains during the first half of the month caused freshets in western Pennsylvania and eastern Ohio. The Ohio River rose above the danger-line at Cincinnati, Ohio, on the 25th, and at Louisville, Ky., on the 26th, and on the 28th it was 5.7 feet above the danger-line at Cincinnati, and 7.6 feet above the danger-line at Louisville. Navigation and railroad traffic were interfered with at Cincinnati by the flood, and the river overflowed its banks and flooded cellars at Louisville. During the latter part of the month great damage was caused in west-central Kentucky by the overflow of the Green River. In the vicinity of Findlay and Lima, Ohio, swollen streams caused great damage to railroad tracks and bridges. The Tennessee River and the creeks in Tennessee overflowed their banks, and the lower part of Chattanooga, Tenn., was flooded. Damage was caused near Waco, Tex., by overflowing streams. At Fort Verde, Ariz., the Verde River reached the highest point

known at that place on the 21st, drowning cattle and washing out irrigating ditches, and a large area of the Gila Valley was under water during the latter part of the month, flooding sections which had been considered safe from inundation, and severely damaging irrigating canals. On the 22d a large storage dam built across the Hassayampa River about thirty miles above Wickenburg, Ariz., gave way under pressure of floods caused by heavy rains and melting snow, causing loss of life and destroying considerable property.

### STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during February, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, February, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La. ....	29.9	28	20.5	13	17.9	2.6
<i>Arkansas River:</i>						
Fort Smith, Ark. ...	22.0	5, 16	11.8	2	5.3	6.5
Little Rock, Ark. ...	23.0	28	19.0	2	9.5	9.5
<i>Missouri River:</i>						
Ft. Buford, N. Dak.*	21.0	12	8.0	28	0.7	7.3
Kansas City, Mo. ...	21.0	12	8.0	28	0.7	7.3
<i>Mississippi River:</i>						
Saint Paul, Minn.*	14.5	17	11.4	1	8.3	3.1
La Crosse, Wis.*	16.0	14	10.0	1	8.3	3.1
Dubuque, Iowa ...	15.0	13	2.8	24	1.0	1.8
Davenport, Iowa ...	14.0	10	2.9	26	0.3	2.6
Keokuk, Iowa ...	15.0	17	11.4	1	8.3	3.1
Saint Louis, Mo. ...	32.0	8	11.4	7	33.1	8.7
Oairo, Ill. ....	40.0	17	34.1	9, 10	29.4	4.7
Memphis, Tenn. ...	40.0	1, 2	41.8	1	42.0	4.2
Vicksburg, Miss. ...	41.0	28	46.2	1	13.4	2.3
New Orleans, La. ...	13.0	27, 28	15.7	1	13.4	2.3
<i>Ohio River:</i>						
Pittsburgh, Pa. ....	22.0	21	18.8	14	6.7	12.1
Parkersburg, W. Va. ...	38.0	23	26.2	1	11.5	14.7
Cincinnati, Ohio ...	50.0	28	55.7	1	22.3	33.5
Louisville, Ky. ....	25.0	28	32.6	1	9.9	22.7
<i>Cumberland River:</i>						
Nashville, Tenn. ...	40.0	28	43.4	23	12.6	30.8
<i>Tennessee River:</i>						
Chattanooga, Tenn. ...	33.0	28	34.8	22	7.1	27.7
Knoxville, Tenn. ...	29.0	28	23.0	6	1.4	21.6
<i>Monongahela River:</i>						
Pittsburgh, Pa. ....	29.0	21	18.8	14	6.7	12.1
<i>Savannah River:</i>						
Augusta, Ga. ....	32.0	28	21.9	8	7.2	14.7
<i>Willamette River:</i>						
Portland, Oregon ...	15.0	5	28.7	28	1.3	27.4

\*Frozen.

The above table shows that the Mississippi River was 1.8 foot above the danger point at Cairo, Ill., on the 17th; 0.1 foot above at Memphis, Tenn., on the 1st and 2d; 5.2 feet above at Vicksburg, Miss., on the 28th; and 2.7 feet above at